

## Antibacterial effects of *Artemisa aucheri* leaf and Spirulina Blue-Green algae aqueous and alcoholic extracts on the multidrug-resistant *Klebsiella pneumoniae* isolated from the patients with pneumonia

Samaneh Rouhi<sup>1, 2, 3</sup>, Rashid Ramazanzadeh<sup>4</sup>, Shadieh Mohammadi<sup>5</sup>, Alina Abodollahi<sup>6, 7</sup>, Pegah Shakib<sup>8</sup>, Bahman Mohammadi<sup>9</sup>, Amjad Ahmadi<sup>10</sup>

1. PhD of Medical Bacteriology, Student Research Committee, Kurdistan University of Medical Sciences, Sanandaj, Iran., (Corresponding author), Tel: +982833328709, E-mail: roohi.samanh@yahoo.com, ORCID ID: 0000-0003-0160-0924

2. PhD of Medical Bacteriology, Children Growth Research Center, Research Institute for Prevention of Non-Communicable Diseases, Qazvin University of Medical Sciences, Qazvin, Iran. ORCID ID: 0000-0003-0160-0924

3. PhD of Medical Bacteriology, Clinical Research Development Unit, Kosar Hospital, Qazvin University of Medical Sciences, Qazvin, Iran. ORCID ID: 0000-0003-0160-0924

4. Professor of Medical Bacteriology, Cellular and Molecular Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran. ORCID ID: 0000-0002-1644-6352

5. Assistant Professor of Food Hygiene, Environmental Health Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran. ORCID ID: 0000-0002-0711-4305

6. PhD Student of Molecular Medicine, Student Research Committee, Kurdistan University of Medical Sciences, Sanandaj, Iran. ORCID ID: 0000-0002-5282-4672

7. PhD Student of Molecular Medicine, Cellular and Molecular Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran. ORCID ID: 0000-0002-5282-4672

8. Assistant Professor of Medical Bacteriology, Razi Herbal Medicines Research Center, Lorestan University of Medical Sciences, Khorramabad, Iran. ORCID ID: 0000-0003-3525-226X

9. MSc of Medical Microbiology, Student Research Committee, Kurdistan University of Medical Sciences, Sanandaj, Iran. ORCID ID: 0000-0002-2345-246X

10. MSc of Medical Microbiology, Cellular and Molecular Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran. ORCID ID: 0000-0001-9722-8826

### ABSTRACT

**Background and Aim:** Antibacterial effects of *Artemisia* plant and algae have been confirmed. The purpose of this study was to evaluate the antibacterial effect of antibiotics, Spirulina blue-green algae and *Artemisa aucheri* leaf extracts on multidrug resistant (MDR) *Klebsiella pneumoniae*.

**Materials and Methods:** Disk and well diffusion method, the growth minimum inhibitory and bactericidal concentrations (MIC and MBC) were used to evaluate antibacterial effects. Using SPSS 16 software, data were analyzed by analysis of variance (ANOVA) with repeated measures and Bonferroni test ( $p \leq 0.001$ ).

**Results:** The MIC and MBC for amikacin, colicetin, ceftazidime were 4 and for gentamicin and nalidixic acid were 2 and 1  $\mu\text{g}/\mu\text{l}$ , respectively. In disk and well diffusion methods, the highest growth inhibition zones belonged to ethanolic extracts (0.25 mg/ml) of *Artemisia* and algae. The best MIC and MBC for growth were related to ethanolic extracts of *A. aucheri* at the concentration of 0.15 mg/ml. The diameter of growth inhibition zone around the bacterium was directly related to the concentrations of *Artemisia* and Algae extracts ( $p = 0.000$ ).

**Conclusion:** Considering the beneficial antibacterial effects of Spirulina blue-green algae and *A. aucheri* which were confirmed in this study, extraction of the active ingredients of medicinal plants is recommended for the mass production of herbal medicines.

**Keywords:** Antibacterial effect, Extracts, *Artemisa aucheri*, Spirulina blue-green algae, *Klebsiella pneumoniae*

**How to cite the article:** Samaneh Rouhi, Rashid Ramazanzadeh, Shadieh Mohammadi, Alina Abodollahi, Pegah Shakib, Bahman Mohammadi, Amjad Ahmadi. Antibacterial effects of *Artemisa aucheri* leaf and Spirulina Blue-Green algae aqueous and alcoholic extracts on the multidrug-resistant *Klebsiella pneumoniae* isolated from the patients with pneumonia. SJKU 2020;25(4):124-140.